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The influence of organic fertilizers on the yield and quality of watermelons

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ABSTRACT

In connection with a decrease in soil fertility, it is necessary to revise the doses of mineral fertilizers when growing watermelons of the Shirin variety in the Tashkent region of Uzbekistan. It is also necessary to establish the doses of fertilizers that have a positive effect on the yield and quality of the products obtained. The research was carried out at the experimental base of the Research Institute of Vegetables - Melons and Potatoes, located in the Tashkent region. The soils where the studies were carried out are typical gray soils of old irrigation with a humus content in the upper 0-25 cm horizon of about 1%, in the lower 25-40 cm horizon - about 0,7%. Calcareous soil, in texture referring stay to the dark loam average at density. During the research, the previously recommended doses of fertilizers were taken for control. During the experiments, the doses of mineral and organic fertilizers were increased accordingly. Studies have shown that the highest yield of good quality watermelons was obtained when applying 25,0 t/ha of manure in combination with $N_{225} P_{225} K_{150}$ kg/ha and was equal to 21,2 t/ha, which is 37,7% higher than on the control variant ($N_{150} P_{150} K_{100}$ kg/ha) and had good biochemical indicators of product quality: sugars 8,11%, dry matter 9,1%, ascorbic acid 21,6 mg%, nitrogen nitrates 20,6 mg/kg, on the control these indicators were equal to 6,65%, 8,6%, 17,9 mg%,13.2 mg/kg, respectively.

Key words: watermelons, fertilizers, high productivity, biochemistry, soil agrochemical parameters, product quality.

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1. INTRODUCTION

At present, due to intensive farming, soil fertility is decreasing. This was also noted in the Decision President of the Republic of Uzbekistan № PP-2460 " On measures for further reform and development of agriculture for the period from 2016-2020" from 29.12.2015. It talks about an increase in the fertility and efficiency of the use of sown land, an increase in the area occupied by vegetables and melons by 91 thousand hectares, under potatoes - by 36 thousand hectares. Lands are released for vegetable crops and potatoes, which are mostly low-fertile [1].

Intensive use of agricultural land leads to a decrease in their fertility. Before independence, Uzbekistan produced 113 kg of vegetables, 19,3 kg of melons, 50,4 kg of potatoes per capita; after gaining independence in 2019, per capita produced 289 kg of vegetables, 75 kg of potatoes and 52 kg of melons [3].

During the years of independence, the production of potatoes increased 7 times, vegetables -2.8 times, melons -1.8 times [2].

The authors of [4] believe that agriculture combines the totality of a number of ways of continuous, multi-purpose use of land resources by society.

In connection with the increase in the production of vegetable products, it is necessary to revise the doses of applied fertilizers.

2. RESEARCH METHODS

The object of research was the Shirin watermelon variety. The experience was based on the following scheme:

- 1. $N_{150} P_{150} K_{100} \text{ kg/ha}$ control.
- 2. 20 t/ha manure + N_{150} P_{150} K_{100} kg/ha.
- $3.\ N_{225}\,P_{225}\,K_{150}\ kg/ha.$
- 4. 25 t/ha manure + $N_{225} P_{225} K_{150}$ kg/ha.
- 5. $N_{300} P_{300} K_{200}$ kg/ha.
- 6. 30 t/ha manure $+ N_{300} P_{300} K_{200} kg/ha$.

The entire dose of manure, as well as 50% of phosphorus and potassium fertilizers are applied before planting, the remaining 50% of phosphorus and potassium fertilizers, as well as 50% of nitrogen fertilizers are applied in the first feeding, the remaining 50% of nitrogen fertilizers are applied during the period of mass flowering - the beginning of fruit setting.

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3. RESEARCH RESULTS

Experiments with Shirin watermelons were laid in the field in early May The soils are typical gray soils of old irrigation. In the soil during the experiment, in the middle of the growing season after applying all doses of fertilizers and at the end of the growing season, the content of nitrate nitrogen and mobile phosphorus was determined along the horizons of 0-25 cm and 25-40 cm.

The research results showed that at the beginning of the growing season, the soil, where the experiment with watermelons of the Shirin variety was laid, contained a low amount of nitrate nitrogen, in the 0-25 cm soil layer from 16,9 to 11,3 mg/kg, on average from 5 taken samples – 12,6 mg/kg, in a layer of 25-40 cm from 15 mg/kg to 7,4 mg/kg, on average -10,7 mg/kg.

In the middle of the growing season, after applying the entire dose of organic and mineral fertilizers, the content of nitrate nitrogen in the soil increases. And this increase in the content of nitrate nitrogen in the soil goes naturally with an increase in the doses of applied mineral and organic fertilizers. So, when $N_{150}\,P_{150}\,K_{100}\,kg$ /ha (control) was applied, in the soil contained 31,6 mg/kg N-NO₃ in the 0-25 cm layer, 24,9 mg/kg in the 25-40 cm layer, when applying $N_{225}P_{225}K_{150}\,kg$ /ha – 40,1 mg/kg, in a layer of 25-40 cm – 29,4 mg/kg when applying $N_{300}P_{300}K_{200}\,kg$ /ha – 47,3 and 30,5 mg/kg respectively.

If these doses of mineral fertilizers were applied together with organic fertilizers, the content of nitrate nitrogen in the soil increased steadily. So, when making 20 t/ha of manure + $N_{150}P_{150}K_{100}$ kg/ha the nitrate nitrogen content in the 0-25 cm layer of soil was equal to 41,4 mg/kg with in the soil layer 25-40 cm soil – 35,1 mg/kg. Against the background of the introduction of 25 t/ha of manure + $N_{225}P_{225}K_{150}$ kg/ha in a layer of 0-25 cm of soil contained 43,9 mg/kg and in a layer of 25-40 cm of 36,4 mg/kg, while introducing 30 t/ha manure + $N_{300}P_{300}K_{200}$ kg/ha these indicators were 56,5 and 42,6 mg/kg, respectively. Plants in the middle of the growing season, on all nutrition backgrounds, were sufficiently provided with the content of nitrate nitrogen in the soil to show the potential of the variety for obtaining an optimal yield on any particular growing background.

At the end of the growing season, due to the cessation of the use of nitrate nitrogen by watermelon plants in the formation of vegetative mass and yield, the content of nitrate nitrogen in the soil continues to be kept at a sufficiently high level.

Data on the determination of mobile forms of phosphorus in the soil when growing watermelons of the Shirin variety in the Tashkent region showed that the soils of the experimental field at the beginning of the growing season are to a certain extent provided with mobile forms of phosphorus. In the 0-25 cm soil layer before laying the experiment, it contains 22,9 mg/kg. In the middle of the growing season, after the entire dose of fertilizer has been applied, its content increases according to the doses of applied fertilizers.

So, against the mineral background ($N_{150}P_{150}K_{100}$ kg/ha) it was contained in the 0-25 cm layer 46,1 mg/kg, in the 25-40 cm layer -34,7 mg/kg, with the introduction of $N_{225}P_{225}K_{150}$ kg/ha – 50,0 and 42,3 mg/kg, $N_{300}P_{300}K_{200}$ kg/ha – 58,4 and 40,4 mg/kg, respectively.

When mineral fertilizers are applied in combination with organic fertilizers, the content of mobile forms of phosphorus increases due to the applied organic fertilizers. So, when applying 20 t/ha of manure in combination with $N_{150}P_{150}K_{100}$, the soil layer 0-25 cm contained 66,8 mg/kg of mobile forms of phosphorus, in the layer 25-40 cm - 48 mg/kg, when 25 t/ha of manure + $N_{225}P_{225}K_{150}$ kg/ha, respectively – 76,0 and 62,6 mg/kg, when applying 30 t/ha of manure + $N_{300}P_{300}K_{200}$ kg/ha – 83,6 and 66,8 mg/kg. Probably, such a large amount of nutrients is no longer consumed by watermelon plants, but only inhibits their growth and development. By the end of the growing season, the content of mobile forms of phosphorus decreases due to its consumption by plants and leaching by irrigation water. However, it should be noted that the content of mobile phosphorus remains quite high when applying 30 t / ha of manure + $N_{300}P_{300}K_{200}$ kg/ha. Apparently, it is used to a lesser extent for the formation of the harvest of watermelons. Thus, it should be noted that mobile phosphorus is most effectively used by plants against a background of 20 t/ha manure + $N_{150}P_{150}K_{100}$ kg/ha, and 25 t/ha manure + $N_{225}P_{225}K_{150}$ kg/ha.

The data of biometric measurements showed that the greatest length of lashes was observed in watermelons of the Shirin variety in the middle of the growing season when they were grown against an organomineral background. Thus, against a background of 20 t/ha of manure + $N_{150}P_{150}K_{100}$ kg/ha, the length of the lashes was 81,8 cm, against the background of 25 t/ha of manure + $N_{225}P_{225}K_{150}$ kg/ha – 85,6 cm, against the background of 30 t/ha of manure + $N_{300}P_{300}K_{200}$ kg/ha – 89,4 cm. On the control ($N_{150}P_{150}K_{100}$ kg/ha) this indicator was 61,1 cm.

At the end of the growing season, the greatest length of lashes in watermelon plants was noted with the use of high doses of organic and mineral fertilizers: so when was applied $N_{300}P_{300}K_{200}$ kg/ha, the length of the lashes was 140 cm, when 30 t/ha manure was applied + $N_{300}P_{300}K_{200}$ kg/ha - 147,2 on control $N_{150}P_{150}K_{100}$ kg/ha - 112,2 cm. The largest number of side stems 4,1 and 4,2 pieces was observed when growing plants against the background of 25 t/ha manure + $N_{225}P_{225}K_{150}$ kg/ha and 30 t/ha manure + $N_{300}P_{300}K_{200}$ kg/ha.

Table 1 shows data on determining the yield of watermelons of the Shirin variety and their biochemical characteristics. From the data given in the table, we see that the highest yield of watermelons was obtained when organic fertilizers were applied together with mineral fertilizers.

So, when applying 25 t/ha of manure together with $N_{225}P_{225}K_{150}$ kg/ha, the yield of watermelons was

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21,2 t/ha, when applying 30 t/ha of manure + $N_{300}P_{300}K_{200}$ kg/ha - 21,5 t/ha, control $N_{150}P_{150}K_{100}$ kg/ha - 15,4 t/ha. The yield increase was 37,7% and 39,6%, respectively. But where an increase of 39,6% was obtained, a large dose of organic and mineral fertilizers was applied (an additional 5 t/ha of manure, 75 kg N, 75 kg P, 50 kg K, which does not reimburse the costs at cost).

Thus, we believe that the optimal dose of fertilizers to obtain a high yield of good quality watermelons is 25 t/ha of manure $+ N_{225}P_{225}K_{150}$ kg/ha.

Table Yield and biochemical characteristics of watermelon fruits of the Shirin variety when using increasing doses of fertilizers

Option	Yield, t/ha	% control	Ascorbic acid, mg%	Total sugar, %	Dry matter, %	N- NO ₃ mg/kg
$N_{150}P_{150}K_{100}$ kg/ha - control	15,4	100	17,9	6,63	8,6	13,2
$20 \text{ t/ha manure} + N_{150}P_{150}K_{100} \text{ kg/ha}$	17,4	114,3	20,2	7,97	8,9	16,9
$N_{225}P_{225}K_{150}$ kg/ha	19,5	126,6	19,2	7,81	8,4	18,8
25 t/ha manure +N ₂₂₅ P ₂₂₅ K ₁₅₀ kg/ha	21,2	137,7	21,6	8,11	9,1	20,6
$N_{300} P_{300} K_{200} kg/ha$	19,8	128,6	16,1	7,13	8,7	29,4
$30 \text{ t/ha manure} + N_{300}P_{300}K_{200} \text{ kg/ha}$	21,5	139,6	16,6	7,20	8,8	28,2

From the data given in Table 1, we see that the best in quality were the fruits of watermelons grown against a background of 25 t/ha of manure in combination with $N_{225}P_{225}K_{150}$ kg/ha and contained 9,1% of dry matter, including 8,11% sugars, of which 5,19% disaccharides (sucrose) and 2,92% monosaccharides, 21,6 mg% ascorbic acid, 20,6 mg/kg nitrate nitrogen, which is within the MPC.

On the control variant $(N_{150}P_{150}K_{100} \text{ kg/ha})$, the fruits of watermelon contained 6,63% sugars, including disaccharides (sucrose) 3,92%, ascorbic acid – 17,9 mg/%, nitrate nitrogen – 13,2 mg/kg.

4. **CONCLUSIONS**

Thus, based on the studies carried out in the Tashkent region, we believe that when growing watermelons, the optimal dose of fertilizers is 25 t/ha of manure in combination with $N_{225}P_{225}K_{150}$ kg/ha. When applying this dose of fertilizers, we received an increase in the yield of 37,7%, with good biochemical quality of the products obtained.

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